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Cooperative Geologic Project

File Report

Geologic Reconnaissance Along the Proposed Location for the Orange-Athol Bypass Between Ward Hill Road Phillipston, and the Orange Town Line, Mass.

by

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General Statement

This investigation was undertaken to determine the surface geology along the proposed relocation of a segment of Route 2 and to outline the areas that might yield gravel suitable for highway purposes.

A reconnaissance geologic map on a scale of two inches to one mile was prepared and is included as a part of this report (see "Surficial Geologic Map of Parts of Orange and Athol Quadrangles"); the approximate location of the proposed highway centerline is plotted on this map.

The work was done in August 1953 as a part of a cooperative program of the Massachusetts Department of Public Works and the United States Department of the Interior, Geological Survey.

Location

The territory examined for this report is in the towns of Phillipston and Athol. These towns are located in the Athol and Orange $7\frac{1}{2}$ minute quadrangle maps of the U. S. Geological Survey.

Surface Geology

The areal distribution of the surficial and bedrock formations examined along the general location of the roadsite is shown on the accompanying geologic map.

Bedrock exposures occur at various places along or close to the roadsite from the vicinity of Phillipston Reservoir to Pond Road, but are most numerous between Pleasant Street and South Athol Road, along which segment the terrane is chiefly a till-bedrock area, except for a distance of about half a mile where the site crosses a swamp and outwash area south of Lake Ellis. West of Partridgeville Road and Pond Road, and extending to South Main Street, Orange, the terrane is underlain by an outwash plain of sand and gravel. However, it is likely that bedrock might be reached at a relatively shallow depth over all of the area mapped with the possible exception of that portion underlain by gravel west of South Athol Road. Although the bedrock of the area is quite variable, all of the types likely to be encountered are relatively resistant crystalline schists and granitic rocks. The four formations present — the Brimfield schist, the Hardwick granite, the Dana diorite, and the Monson granodiorite -- have been described by Emerson (1917). Hadley (1949) redescribed and redefined some of these formations in his work in the Mt. Grace quadrangle, adjacent to the Orange quadrangle on the north.

The centerline traverses an area underlain by the Hardwick granite from Ward Hill Road to a point approximately one-quarter mile west of the west end of Reservoir No. 1. The Hardwick granite is in most places a dark-colored, biotitic granite gneiss. It is commonly porphyritic in texture, with relatively large phenocrysts of feldspar in a coarse, fairly even-textured groundmass. From the western boundary of the area underlain by Hardwick granite to the swamp 0.65 miles west of Pleasant Street the centerline traverses an area underlain by the Brimfield schist, a garnetiferous quartz-mica schist. The Brimfield schist weathers readily, and the

disintegration and decomposition of the iron-bearing minerals commonly gives it a rusty color. From the east edge of the swamp 0.65 miles west of Pleasant Street to the South Athol Road the underlying bedrock is a mixture of contorted Brimfield schist and hard crystalline rocks, the Dana diorite and Monson granodicrite. The few bedrock exposures west of South Athol Road are of the Monson granodiorite.

The surficial deposits found along the proposed centerline are of six general types. The first of these, most common in the areas of larger hills as a relatively thin veneer covering the bedrock, is a fairly loose, yellowish brown to olive brown, sandy till (ground moraine, gm). The lined areas on the map are those in which the till cover is extremely thin so that bedrock is relatively near the surface. In deeper exposures elsewhere the till is quite compact and its color is more generally olive brown, with a reddish tint where much of the Brimfield schist is included, and a lighter, bluish tint where many of the rock fragments are of the lighter-colored Monson granodiorite. These till areas are marked commonly by a concentration of fairly large boulders on the surface, especially on the steeper slopes. The second type of surficial deposit is fairly coarse-textured sandy gravel; it is found as ridges (ice-channel fillings or eskers, ic) and elongate to round hills (kames, k). Such deposits were laid down by streams. In places similar gravel-sand deposits are found relatively high on the valley walls, such as the kames 0.15 miles west of Reservoir No. 1, about one and one-half miles west of the east end of the proposed centerline. A third type of surficial deposit, sand and fine sandy gravel, is found as terraces (kame terraces, kt), isolated hills (kames, k), and areas of irregular topography generally bordering kame terraces (kame fields, k). These finer-textured

deposits are, in general, of later origin than are those of coarser texture.

Three more kinds of surficial deposits are fine-grained alluvium (sgu) found along modern stream valleys and in a few small local depressions, bog deposits (s) laid down in post-glacial bogs and swamps, and artificial, or man-made, deposits (f) as earth-fill and boulder dams at the outlets of the various reservoirs and as highway "fill" across depressions and in bridge approaches. Because of the problems related to the drainage of boggy deposits, and the frequent instability of fill on such deposits, the depth and physical characteristics of the bogs should be determined.

Possible Sources of Sand and Gravel

Areas of granular materials suitable for fill, subgrade material or aggregate are indicated by two colors on the map, the discrimination being based on the dominance of sand or gravel in the deposits. No attempt is made to discriminate the materials on the basis of adaptability for various uses. The map is therefore a guide to localities for further and more detailed quantitative and compositional investigations. It is therefore a prospecting guide.

In general the coarser clastics (gravel predominant) will be found in areas indicated as ice-channel fillings (ic) and kames (k). Three such localities are : (1) the esker ridge roughly parallel with and 1/4 to 1/3 mile west of South Athol Road (east side of Kelton Hill); (2) esker segments 1/4 mile west of Petersham Road, bordering the swamp area south of Lake Ellis; and (3) esker crossing the junction of Conant Road and Sherborn Road, 0.6 mile northeast of Conant Hill.

Areas of predominant sand, but containing subordinate beds and lenses of fine to medium gravel, are indicated as kame terraces and kames (kt and k).

Such areas are relatively broad and flat-topped. There are two major areas (kt) of these materials. One of these occupies a large and irregular area extending from Petersham Road westerly to Conant and Sherborn Roads; this area partly surrounds two of the esker ridges mentioned above. The second is between South Athol Road and South Main Street, Orange; within this extensive area, the higher, eastern part is more diversified topographically and appears to contain a higher content of gravelly material than the more extensive and lower western part. Several small kame fields (k) are indicated in the area between Kelton Hill and Petersham Road, which also contain a larger proportion of gravelly material than the broader and lower terraces described above. The largest of these is on the north side of Ellinwood Brook, and just west of Pleasant Street, Athol; several small hillocks (k) predominantly of poorly sorted, coarse to medium gravel, occur in this area.

References

Emerson, B. K., Geology of Massachusetts and Rhode Island, U. S. Geological Survey, Bulletin 597, 1919.

Hadley, J. B., Bedrock Geology of the Mount Grace Quadrangle, Massachusetts, U. S. Geological Survey, Geologic Quadrangle Map Series, 1949